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SOCIOECONOMIC IMPACTS OF WESTERN ENERGY RESOURCE DEVELOPMENT

VOLUME I: SUMMARY AND IMPLICATIONS

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A 4-volume analysis of the socioeconomic impact assessment process for western energy resource developments. Vol. I provides a general analysis of the state-of-the-art, explores the implications of uncertainty and risk for both preparers and users of impact assessments, and recommends performance/evaluation standards for future assessments. Vol. II details assessment needs and alternative approaches and describes step-by-step a demonstration methodology. Vol. III describes the application of the demonstration methodology in two case studies: northwest Colorado and southeast Utah. Vol. IV documents the computer program which incorporates the demonstration methodology.

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VOLUME I: SUMMARY AND IMPLICATIONS

For

Council on Environmental Quality, Executive Office of the President
Resource and Land Investigations Program, U.S. Geologic Survey
U.S. Department of Energy
Environmental Protection Agency
National Science Foundation

By

Denver Research Institute

and

Resource Planning Associates

June 1979

PREFACE

This is one of a series of four volumes analyzing the socio-economic impact assessment process for western energy resource developments. The volumes deal primarily with a set of impacts which typically occur when large-scale resource developments are superimposed on sparsely populated, isolated local environments. The volumes are one result of a multi-year research project, sponsored by several federal agencies.

During this project, the existing state-of-the-art for impact assessment in rapid growth situations has improved considerably. The thinking of the federal agencies has evolved, and the objectives of this research effort have been modified several times. They describe and evaluate the state-of-the-art in assessing these recurring impacts. They also provide examples of other types of impacts which may occur under certain circumstances and suggest means for identifying and analyzing them.

Sudden changes and high levels of risk and uncertainty are inherent characteristics of most western energy developments. The magnitude, timing, and duration of the energy developments themselves are often uncertain. In spite of recent improvements, the current state-of-the-art in impact assessment remains limited in its ability to take into account the effects of major discontinuities in economic activities, population growth and social environments. It is also limited in its ability to take into account the effects of one component of change on other components, for example, the effect of housing conditions on individual stress levels and population migration rates.

These difficulties in forecasting, whether due to the energy development decisions themselves or to the limitations of forecasting

techniques, do more than just cause problems for the impacts analyst. They are themselves contributors to adverse impacts. Excessive risk is a major cause of breakdowns in both public and private capital markets. Inadequate early warning limits the capacity for physical, economic and social institutional planning.

Volume I in this series provides a general analysis of the state-of-the-art, explores the implications of uncertainty and risk for both preparers and users of impact assessments, and recommends performance/evaluation standards for future assessments.

Volumes II, III, and IV are addressed to practitioners in the impact assessment field. Volume II provides detailed analyses of assessment needs and alternative approaches for each component of a typical assessment process. It also provides a step-by-step description of a demonstration methodology for each component. This demonstration methodology has been designed particularly for use by state-level impact assessment teams and for facilitating extensive sensitivity testing to explore the implications of uncertainty.

Volume III describes the application of the demonstration methodology in two case study areas: northwest Colorado and southeastern Utah. The Colorado case study examines the magnitude of uncertainty due to three general factors: (1) difficulty in forecasting the magnitude, timing, and duration of development (particularly in an embryonic synfuels industry); (2) difficulty in forecasting the geographic distribution of impacts; and (3) difficulties in quantifying individual components of impacts (e.g., public expenditure increases). The Utah case study explores

the importance of local primary data to the analysis. Analyses were first completed using only secondary data; they were then repeated using primary data, and the results compared.

Volume IV documents the computer program which incorporates the demonstration methodology.

This research project was carried out by the Denver Research Institute and Resource Planning Associates. It was jointly sponsored by the President's Council on Environmental Quality, the Department of the Interior, Geological Survey, the Environmental Protection Agency, the Department of Energy, and the National Science Foundation. The project included substantial inputs from representatives of the sponsoring agencies. Project participants and sponsor representatives are listed below.

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TABLE OF CONTENTS

	Page
PREFACE	iii
LIST OF EXHIBITS	viii
I. INTRODUCTION	1
II. THE SOCIOECONOMIC IMPACT ASSESSMENT PROCESS	5
Impact Issues	6
Requirements for Integrated Assessment	8
Methodological Requirements for Use in Mitigation Planning	10
III. THE CURRENT STATE-OF-THE-ART	13
Existing Methodologies	14
Significance of Remaining Limitations	15
IV. IMPLICATIONS	27

LIST OF EXHIBITS

Exhibit No.		Page
II-1.	OVERVIEW OF AN INTEGRATED ASSESSMENT METHODOLOGY, INCLUDING COMPONENT ANALYSES OF INCOMING INDUSTRY AND THE HOST COMMUNITY	9
III-1.	METHODOLOGY ISSUES AND REMAINING PROBLEMS	16
III-2.	SENSITIVITY OF SELECTED RESULTS TO CHANGES IN THE MAGNITUDE OR RATE OF BUILD-UP OF ENERGY DEVELOPMENT (NORTHWEST COLORADO CASE STUDY)	19
III-3.	SENSITIVITY OF SELECTED RESULTS TO CHANGES IN THE MAGNITUDE AND RATE OF BUILD-UP OF ENERGY DEVELOPMENT (SOUTHEASTERN UTAH CASE STUDY)	20
III-4.	SENSITIVITY OF SELECTED RESULTS TO CHANGES IN GEOGRAPHIC DISTRIBUTION OF IMPACTS (NORTHWEST COLORADO CASE STUDY)	21
III-5.	SENSITIVITY OF SELECTED RESULTS IN ASSESSMENT METHODOLOGY AND ESTIMATED IMPACTS (NORTHWEST COLORADO CASE STUDY)	23
III-6.	SENSITIVITY OF SELECTED RESULTS TO USE OF PRIMARY DATA (SOUTHEASTERN UTAH CASE STUDY)	25

I. INTRODUCTION

Socioeconomic impact assessments of western energy developments are conducted to meet a variety of different needs. Federal agencies involved in the energy development process need them, and usually are required to have them, in order to plan their actions with an understanding of the broad consequences.* The impacts can be so large that a variety of other federal agencies having an interest in or providing services to nearby areas (e.g., Forest Service, FmHA, HEW, and HUD) also require data from the assessments in order to plan their programs.

States have increasingly realized that they have a major stake in the assessment process--not only in order to assure the health and welfare of their communities but also to plan their own programs, expenditures, and revenues. Private energy developers have similarly become interested--not only to meet permitting requirements but to insure the viability and profitability of their projects.** In some instances, energy developers, private or public, may be required to plan for the amelioration of adverse impacts as a condition for development.***

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*Assessments of federal actions with potentially significant impacts are required under the National Environmental Policy Act (NEPA). Where no significant physical environmental impacts are anticipated, the likelihood of socioeconomic effects is not sufficient to require a formal assessment.[1] However, once the formal assessment process is required, socioeconomic impacts must be considered.

**Socioeconomic problems can lead to a host of factors which adversely affect worker productivity and project costs.[2]

***Recent court decisions point towards the possibility of judicially enforced mitigation activities under NEPA.[3]

Most important, however, are the affected communities themselves. Residents in a variety of different roles--public officials, private entrepreneurs, long-time residents in general, and newcomers--must recognize major changes and develop appropriate responses in advance if major economic and social disruption is to be avoided.

Methodological procedures and the assessment process in general will vary depending on the emphasized purpose of the assessment and the position of the analyst (i.e., whether he/she is a federal employee or consultant, state employee or consultant, industry employee or consultant, or community planner). However, the most valuable contribution any assessment can make is to improve the capacity of any or all of these different parties-at-interest to identify and respond to change.

This volume summarizes the findings of the research project on assessment methodologies and describes their implications for users of assessments. Specific impact issues are identified, and alternative means for analyzing each issue area are described. The limitations in the current state-of-the-art in assessment are evaluated. Finally, the outputs of the assessment process and its limitations are related to the policy analysis process required to develop appropriate responses.

As previously noted, this volume and the project as a whole concentrate on the most common western energy development situation--placing a new, relatively large-scale energy resource project in a sparsely populated area. The methodological descriptions and analyses which follow have only peripheral relevance for cases where the proposed development is located near major population centers. They are in most instances relevant

to a frequent special case in energy development--the project involving an Indian tribe and/or reservation. However, they would need to be carefully reviewed and modified, both with respect to general Indian development issues and with respect to the specific tribe involved, before application.

REFERENCES--VOLUME I--SECTION I

1. Council on Environmental Quality, CEQ Guidelines 1508.14, Federal Register, 43:230 (November 29, 1978), p. 56004.

2. John S. Gilmore and Mary K. Duff, Boom Town Growth Management: A Case Study of Rock Springs--Green River, Wyoming (Boulder, Colorado: Westview Press, 1975).

3. "It was also well settled that NEPA's mandate includes consideration and amelioration of socioeconomic and human resource impacts upon the environment. For example, in Trinity Episcopal School Corp. v. Romney, 387 F. Supp. 1044 (S.D.N.Y. 1974), the court held 'essential to a NEPA study' such factors as the impact of the project on the 'quality of community services'--such as deterrence of 'crime, police protection, schools, hospitals, fire protection, recreation, transportation, and commercial establishments.' 387 F. Supp. at 1078. See also Chelsea Neighborhood Associations v. United States Postal Service, 516 F.2d 378, 388 (snd Cir. 1975) ('human factors' must be considered under NEPA); Hanley v. Mitchell 460 F.2d 640, 647 (2d Cir.), cert. denied, 409 U.S. 990 (1972); Ely v. Velde, 451 F.2d 1130 (4th Cir. 1971); Prince George's County, Maryland v. Holloway, 404 F. Supp. 1181 (D.D.C. 1975)."--Highland County, VA, brief before the Federal Power Commission (Project No. 2716, Application for license by Virginia Electric and Power Company, scheduled to be delivered June 23, 1976).

II. THE SOCIOECONOMIC IMPACT ASSESSMENT PROCESS

Socioeconomic impacts are here defined as externally induced changes from the state of society which exists or which otherwise could be expected to exist (the baseline conditions). The changes are those affecting social (including economic) systems--and the people and institutions comprising these systems.* Positive impacts are those seen as beneficial; negative impacts are those seen as costly or disruptive. The perceptions of polarity, of course, vary with the values or interests of the perceiver. These variations among different parties-at-interest are important factors in defining impacts.

Impact assessment is defined to include more than anticipation of impacts. It includes growth forecasting and monitoring, impact forecasting, impact evaluation and monitoring, and it may eventually extend to mitigation planning (for avoiding or ameliorating negative impacts). To date, most assessments of western energy impacts have concentrated on descriptions of direct impacts on employment, population, and public revenues. Using this definition of assessment, however, the objectives of the process are much broader. In order to be most useful as tools for mitigation and planning, impact assessments need to include:

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*"Socioeconomic impacts" is a dubious term in overwhelmingly common usage. Social impacts or societal impacts would be better general phrases; if socioeconomic is to be used, so should sociopolitical, sociocultural, and so forth. However, the authors accede to the common usage to mean all of the above classes of impacts.

(1) Identification of other components of change--including indirect effects, such as those on housing, and less quantifiable effects, such as those on social structure;

(2) Provision of impact forecasts in a form usable for mitigation analysis; and

(3) Anticipation of constraints to mitigation.

Impact Issues

Developing a large-scale resource project in a sparsely populated area produces rounds of impacts which directly or indirectly produce changes for virtually every person and institution with the host community. The fundamental causes of most socioeconomic impacts are the magnitude and rate of increase in local payrolls and population which result from the project. Increases in payrolls and population in-migration usually result in favorable impacts on total personal income. However, they also usually bring serious problems in public finance and housing as well as social stress. Special problems can occur where one segment of the population (e.g., the elderly) does not participate in the growth in personal income; where competition for scarce resources (e.g., water supplies or scenic areas) is involved; and/or where unique local cultures (e.g., Indian tribes) exist.

Impact issues which recur with most western energy developments include:

- Increased employment;
- Increased personal incomes;
- Migration of large numbers of newcomers into the community;

- Housing problems,
  - Inflation in costs and an inability to pay for housing,
  - Housing shortages;
- Local public finance problems,
  - Tax lead time problems causing public sector cash flow difficulties,
  - High financial risk and difficulty in borrowing,
  - Shortages in facilities and services,
  - Jurisdictional mismatches;
- Local public finance advantages,
  - Increased tax bases in jurisdictions which include energy facilities but do not need to accommodate newcomer residents,
  - Long-term growth in tax bases beyond growth in expenditure requirements for most taxing jurisdictions which include the energy project;
- Changes in the local social structure, polity and culture;
- Increased personal, family, and institutional stress resulting from change.

Other impacts which have been observed in some instances, include:

- Increased intention of young people who would otherwise leave the community in search of better jobs;
- Problems in other sectors of the local economy (e.g., agriculture and tourism) due to an inability to compete for scarce resources such as water and labor;
- State-level public finance problems;
- Urban sprawl;
- Public health problems associated with public facilities shortages and/or urban sprawl;
- Transportation problems;
- Increased stresses between divergent cultural groups;
- Dislocation problems, as the resource is depleted and the energy project closes.

Constraints to mitigation may include:

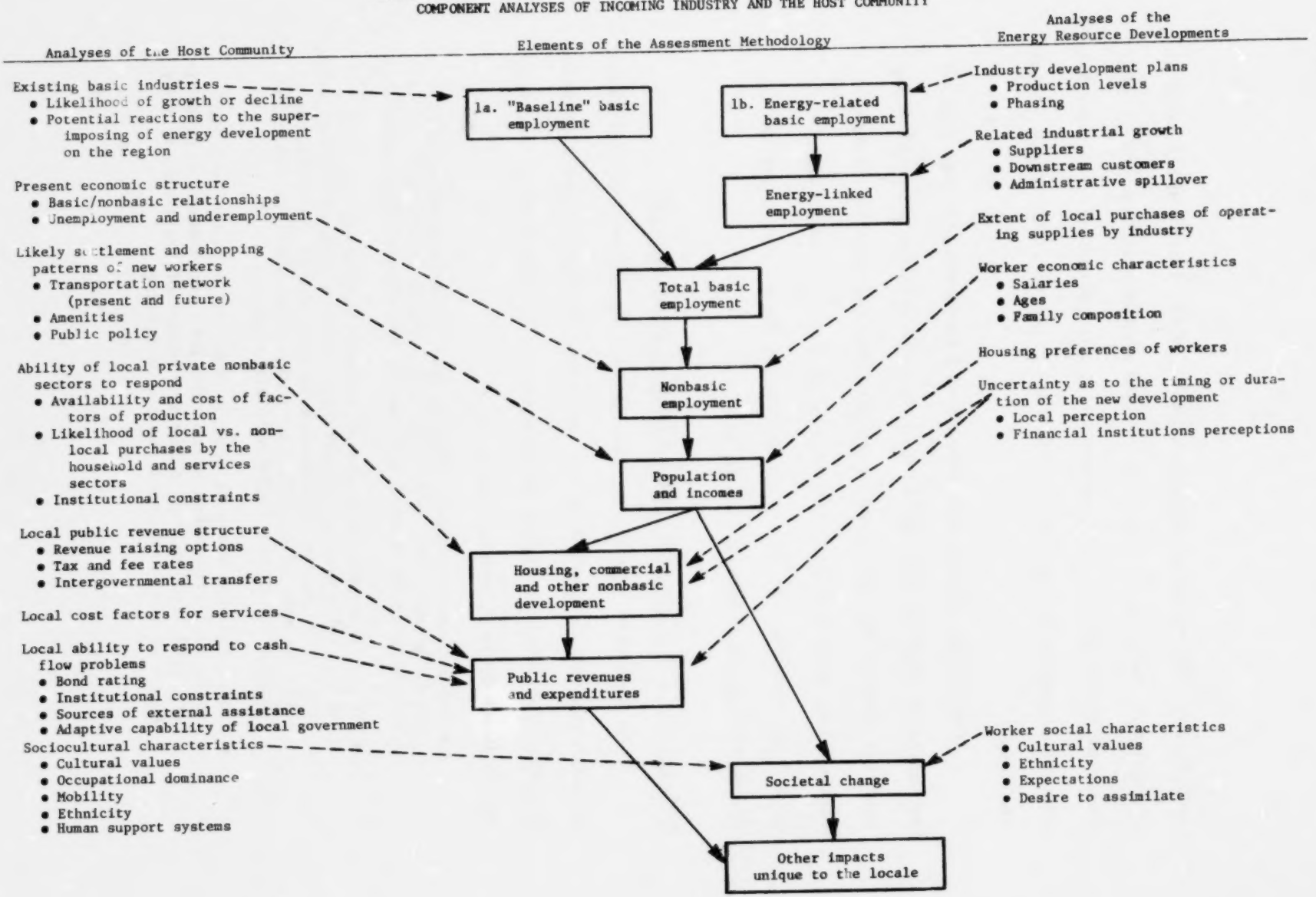
- Lack of experience by local officials in planning, grantsmanship, bond issuance, and cash flow management;
- Statutory limitations on public borrowing;
- Lack of experience in the private sector in correspondent banking, secondary mortgage brokering, and housing development;
- Absence of mechanisms to assist in coordinating development plans by energy developers, public officials, and other private entrepreneurs;
- Absence of mechanisms to assist in assimilating newcomers into the community;
- Absence of institutions to assist in managing personal and group stress;
- Lack of credibility in growth and impact forecasts.

Requirements for Integrated Assessment

The magnitude and timing of impacts in specific development situations are as much a function of the characteristics of the local socioeconomic environment as of the characteristics of the energy development itself. Furthermore, each component of change is closely related to one or more other components.

Exhibit II-1, a diagram of an integrated assessment process, illustrates this relationship. Individual elements of the assessment methodology are evaluated based on prior analysis of the community, the proposed development, and other components. For example, the housing element is analyzed based on local cost factors and potential institutional constraints (e.g., land and credit shortages), on the housing preferences of incoming workers, and on prior analyses of population

EXHIBIT II-1. OVERVIEW OF AN INTEGRATED ASSESSMENT METHODOLOGY, INCLUDING COMPONENT ANALYSES OF INCOMING INDUSTRY AND THE HOST COMMUNITY


Analyses of the Host Community
Elements of the Assessment Methodology
Analyses of the Energy Resource Developments
Existing basic industries
• Likelihood of growth or decline
• Potential reactions to the superimposing of energy development on the region
Present economic structure
• Basic/nonbasic relationships
• Unemployment and underemployment
Likely settlement and shopping patterns of new workers
• Transportation network (present and future)
• Amenities
• Public policy
Ability of local private nonbasic sectors to respond
• Availability and cost of factors of production
• Likelihood of local vs. nonlocal purchases by the household and services sectors
• Institutional constraints
Local public revenue structure
• Revenue raising options
• Tax and fee rates
• Intergovernmental transfers
Local cost factors for services
Local ability to respond to cash flow problems
• Bond rating
• Institutional constraints
• Sources of external assistance
• Adaptive capability of local government
Sociocultural characteristics
• Cultural values
• Occupational dominance
• Mobility
• Ethnicity
• Human support systems
1a. "Baseline" basic employment
1b. Energy-related basic employment
Energy-linked employment
Total basic employment
Nonbasic employment
Population and incomes
Housing, commercial and other nonbasic development
Public revenues and expenditures
Societal change
Other impacts unique to the locale
Industry development plans
• Production levels
• Phasing
Related industrial growth
• Suppliers
• Downstream customers
• Administrative spillover
Extent of local purchases of operating supplies by industry
Worker economic characteristics
• Salaries
• Ages
• Family composition
Housing preferences of workers
Uncertainty as to the timing or duration of the new development
• Local perception
• Financial institutions perceptions
Worker social characteristics
• Cultural values
• Ethnicity
• Expectations
• Desire to assimilate

and income. The societal changes element, which is primarily based on demographic changes, on new worker social characteristics, and on the existing social and cultural environment, also allows for the possibility that shortages in housing and public facilities will exacerbate social problems.

Continuing through the integrated assessment process, initial estimates of impacts are used to generate alternatives for exploiting positive changes and for avoiding or ameliorating negative changes. Furthermore, such a process can be used to identify constraints to mitigation alternatives and/or to reforecast impacts assuming that a set of mitigating policies were in effect.

Methodological Requirements for Use in Mitigation Planning

As indicated previously, the forecasting methodology and manner in which results are presented are important in facilitating mitigation efforts. The level of detail in forecasts affects both their accuracy and their usefulness, specifically:

- Population and income changes need to be geographically distributed. (For most planning purposes, they need to be distributed by area of residence, not area of employment.)
- Public finance analyses must be done separately for each taxing and spending jurisdiction, taking into account existing revenue structure differences if they are to be accurate. (This is also required if they are to be used for financial planning or impact assistance planning.)
- Public finance analyses must be done on at least an annual basis, with procedures which take into consideration expenditure lead time and lag times in receipt of revenues, if they are to be used for local capital budgeting.

The integrated nature of the impacts present other requirements for detail, for example:

- If the income analysis is to be used as an input for housing analysis, then an income distribution must be estimated.
- If population, income, and/or housing analyses are to be used as inputs for public finance analysis, they too must be allocated to individual taxing jurisdictions.

In order to be accepted by the local parties-at-interest engaged in mitigation planning, the methodologies used for analyzing individual elements must have credibility. In practice, this usually means that (1) the methodologies do not grossly offend common sense (for example, by using national public expenditure data or standards in a small rural community); and (2) they are straightforward, so that users of the information can intuitively understand the concepts behind the methodology without absorbing the details.

III. THE CURRENT STATE-OF-THE-ART

The problem of assessing the socioeconomic impacts of western energy developments is a relatively new one. In the last five years, however, there has been a very rapid increase in the number of methodologies available. To a large degree, these methodologies have been taken from other problem areas (e.g., regional economics, cost/revenue analyses for suburban land developments, social indicators, and technology assessment) and adapted.

In spite of the rapid growth, both in number of alternatives and in the level of sophistication of the alternatives, the forecasting process remains a primitive art. This is partly due to the newness of the field and the absence of longitudinal data on different previous experiences. However, it is mostly the result of the nature of the problem. The forecaster is faced with four difficult classes of uncertainty:

(1) The future of the primary driver of the impacts--the energy development(s) itself--is likely to be highly uncertain. The timing, rate of build-up, and ultimate size of energy-related projects are subject to a large number of unknowns, including foreign energy prices, change in domestic electricity markets, technological change, the possibility of environmental litigation and changes in federal energy policy.

(2) There are significant conceptual and empirical difficulties for many of the individual steps required in the assessment process. Most forecasting methodologies require some inferences based on present conditions and relationships. For many energy projects, the magnitude of growth is so large relative to the existing population base that the future may bear little resemblance to the past.

(3) It is difficult to treat many of the interrelationships between assessment steps. For example, housing shortages may reduce public revenues and aggravate social stress. Housing problems may also lead to lower rates of population migration.

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(4) It is difficult to forecast the responses of the various parties-at-interest. With proper planning, many potentially negative impacts can be ameliorated or avoided altogether.

Recent improvements in methodologies promise to be successful in reducing the second class of uncertainty, the conceptual and empirical difficulties.

Existing Methodologies

The existing literature on impact assessment methodologies falls into four major categories: (1) previous impact assessments; (2) applications from other related fields (e.g., fiscal impacts of suburban land development); (3) recent investigations of specific components of impact questions (e.g., construction worker demographic characteristics); and (4) several recently developed computerized integrated assessment models. As indicated previously, most impact assessments to date have not taken full advantage of the current state-of-the-art.

Volume II of this series reviews forecasting problems and methodologies available for conducting each of nine commonly required impact assessment steps: (1) describing energy developments; (2) describing the existing community; (3) forecasting indirect economic activity; (4) forecasting population and income; (5) analyzing the geographic distribution of impacts; (6) analyzing housing; (7) analyzing public finance; (8) analyzing sociocultural change; and (9) identifying and analyzing other impact issues. Methodologies exist to conduct most of these steps more effectively than they have been conducted in the past. However, problems still remain.

Exhibit III-1 (on the following page) summarizes the issues which must be addressed and the conceptual and empirical problems which still confront the analyst in each of these assessment steps.

Volume II also describes in more detail the elements of a demonstration integrated assessment methodology which is constructed to minimize conceptual and empirical problems. The demonstration methodology is designed with combined assessment/mitigation implementation activities at the state level specifically in mind. It is also intended to facilitate sensitivity testing to estimate the degree of uncertainty caused by the forecasting limitations which remain.

Significance of Remaining Limitations

Volume III of this series describes the application of the demonstration methodology in two case study areas: northwest Colorado and southeastern Utah. The volume identifies practical problems in implementing the methodology. It also reports on a number of sensitivity analyses conducted to ascertain the effect of remaining uncertainties concerning the energy developments themselves and the forecasting methodology.

Exhibits III-2 and III-3 illustrate the importance of "normal" ranges of uncertainty in the development of local energy resources for the Colorado and Utah areas respectively. In Colorado, Energy Development Scenario I was developed to reflect the possibility that oil shale projects might begin and then not be carried through to completion. Scenario II was developed to reflect the most likely build-up of oil shale development

EXHIBIT III-1. METHODOLOGY ISSUES AND REMAINING PROBLEMS

Assessment Steps	Methodology Issues	Extent to Which Methodology Problems Still Confront the Analyst
Describing energy development	Accurate inputs for subsequent assessment steps	*Problem is serious*: inherent uncertainty in inputs on timing, magnitude, and duration of development
	Increases in closely linked basic industries	*Problem is minor:* detailed procedures available when required
Describing the existing community	Study area delineation	*Problem is minor:* judgment and tradeoffs concerning assessment resources involved
	Baseline forecasts	*Problem is usually minor:* judgment and tradeoffs required, difficulties arise from competition for scarce resources
Forecasting indirect economic activity	Basic and nonbasic activities division	*Problem is minor:* some data limitations exist
	Differential effects of construction workers	*Problem is significant:* little data exists on this differential
	Likelihood of structural changes in basic/nonbasic relationships over time	*Problem can be serious:* judgment is required by the analyst
	Lags in the build-up of nonbasic activity	*Problem is significant:* lag exists but no one knows how to forecast it
	"Accelerator" effects during the nonbasic build-up period	*Problem is significant:* little is known
Forecasting population and incomes	Local vs. nonlocal hiring	*Problem can be serious:* little data exists. If project is close to metropolitan area this is important

EXHIBIT III-1. (continued)

Assessment Steps	Methodology Issues	Extent to Which Methodology Problems Still Confront the Analyst
	Demographic characteristics of newcomers	*Usually no problem:* cross-sectional data now exists
	Labor participation rates, and second household incomes, among newcomers and old-timers	*Problem is significant:* little data exists
Analyzing the geographic distribution of impacts		*Problem is serious:* existing techniques do not work well
Analyzing housing	Effective housing demand	*Significant problem:* obtaining income distribution is difficult
	Presence and effects of institutional constraints (including high risk)	*Significant problem:* judgment is required
Analyzing public finance	Revenue shortfalls, or cash flow problems	*Significant problem:* magnitude and timing of expenditures remains difficult to forecast
	Revenue mismatches between jurisdictions	*No problem:* (provided geographic distribution analysis is correct)
	Effects of high risk	*Significant problem:* judgment is required
Analyzing sociocultural change	Impact categories identification	*Minor problem:* a variety of checklists and examples now exist
	Magnitude or severity of impacts	*Major problem:* causal inferences are difficult
	Estimates of capacity to assimilate newcomers	*Major problem:* little theory or practice, incoming population characteristics
Identifying and analyzing other impacts	Identification	*Minor problem:* techniques, checklists exist
	Analysis	*Problems vary:* depends on the situation

as of August 1978. An additional analysis, Sensitivity Analysis 1, was conducted to test the effects of a slowdown in the rate of development under this most likely scenario. Between the time these scenarios were specified and this writing, the mood of the oil shale industry has shifted so that Scenario I now appears more likely than Scenario II, unless federal subsidies are inaugurated.

As indicated in Exhibit III-2, this major change in development plans produces forecasting errors of almost 100 percent in many impact categories. A recently announced slowdown in development plans (Sensitivity Analysis 1) would cause significant, but less dramatic errors. Its greatest effect would be on housing and school finance.

Exhibit III-3 illustrates a similar analysis for the Southeastern Utah Primary case study. High and low development scenarios developed by state officials were used. The results show extremely large variations, again especially in housing and public finance.

The assessment step where existing methodologies are most limited appears to be the analysis of the geographic distribution of impacts. Exhibit III-4 illustrates the effect of changes in geographic distribution assumptions on the northwest Colorado forecasts. Sensitivity Analysis 2 was created to reflect a more conservative, but still reasonable, set of assumptions regarding the proportion of newcomers choosing to reside in the Meeker area. As indicated previously, the allocation of impacts to geographic areas is required for mitigation planning. The results confirm this importance, particularly with regard to public finance. This appears to be most critical for the Town of Meeker where the change produces differences of over 50 percent.

EXHIBIT III-2. SENSITIVITY OF SELECTED RESULTS TO CHANGES IN THE MAGNITUDE OR RATE OF BUILD-UP OF ENERGY DEVELOPMENT (NORTHWEST COLORADO CASE STUDY)

Impact Measure	Scenario II Value	Scenario I Value	Scenario I % Change*	Sensitivity Analysis 1 Value	Sensitivity Analysis 1 % Change*
Employment in Rio Blanco County					
Year 7	15,087	2,240	-85.2%	12,459	-17.4%
Year 13	26,181	2,280	-91.3%	22,683	-13.4%
Population in Rio Blanco County					
Year 7	35,200	5,273	-85.0%	27,842	-20.9%
Year 13	61,016	5,363	-91.2%	53,701	-12.0%
Income in Rio Blanco County					
Year 7	75,368	1,204	-98.4%	NA	NA
Year 13	58,508	-96	-100.2%	NA	NA
Total Housing Demand in Rio Blanco County					
Year 7	2,328	35	-98.5%	1,070	-55.0%
Year 13	1,751	-2	-100.1%	1,141	-34.8%
Residual**					
Year 7	739	-6	-100.8%	443	-40.1%
Year 13	341	-1	-100.3%	294	-13.8%
Public Finance Surpluses and Deficits Rio Blanco County					
Year 7	-8,352,688	-1,132,920	+86.4%	-8,026,479	+3.9%
Year 13	-11,774,404	-1,157,161	+90.2%	-12,823,635	-8.9%
Town of Meeker					
Year 7	-1,447,910	-198,849	+86.3%	-1,544,302	-6.7%
Year 13	-3,528,950	-204,401	+94.2%	-3,301,509	+6.4%
School District RE 1					
Year 7	4,728,202	383,467	-91.9%	2,752,434	-41.8%
Year 13	26,411,089	375,098	-98.6%	13,937,725	-47.2%

*Changes are expressed as a percentage of Scenario II values.

**Housing needs which are not reflected in effective demand, given forecasted costs and household incomes, and are therefore not likely to be met.

EXHIBIT III-3. SENSITIVITY OF SELECTED RESULTS TO CHANGES IN THE MAGNITUDE AND RATE OF BUILD-UP OF ENERGY DEVELOPMENT (SOUTHEASTERN UTAH CASE STUDY)

Impact Measure	Scenario I Primary	Scenario II Primary Value	% Change
Employment in Carbon County			
Year 7	12,631	20,237	+60.2%
Year 13	12,433	21,992	+76.9%
Population in Carbon County			
Year 7	31,599	48,948	+54.9%
Year 13	29,823	53,509	+79.4%
Income in Carbon County			
Year 7	3,630	34,036	+837.6%
Year 13	-351	6,485	+194.8%
Housing in Carbon County Total Demand			
Year 7	122	1,027	+741.8%
Year 13	10	229	+219.0%
Residual*			
Year 7	89	414	+365.2%
Year 13	-3	84	+2900.0%
Public Finance Surpluses and Deficits			
Carbon County			
Year 7	196,806	598,806	+204.3%
Year 13	-1,780,673	1,449,060	+181.4%
City of Price			
Year 7	219,758	-3,110,188	-1515.3%
Year 13	-1,903,801	-4,608,508	-142.1%
Carbon County School District			
Year 7	4,327,175	9,529,721	+120.2%
Year 13	4,268,640	12,970,695	+203.9%

*Housing needs which are not reflected in effective demand, given forecasted costs and household incomes, and are therefore not likely to be met.

EXHIBIT III-4. SENSITIVITY OF SELECTED RESULTS TO CHANGES IN GEOGRAPHIC DISTRIBUTION OF IMPACTS (NORTHWEST COLORADO CASE STUDY)

Impact Measure	Scenario II Value	Sensitivity Analysis 2 Value	% Change
Employment in Rio Blanco County			
Year 7	15,087	12,010	-20.4%
Year 13	26,181	19,271	-26.4%
Population in Rio Blanco County			
Year 7	35,200	26,948	-23.4%
Year 13	61,016	44,217	-27.5%
Total Housing Demand in Rio Blanco County			
Year 7	2,328	2,002	-14.0%
Year 13	1,751	1,490	-14.9%
Residual*			
Year 7	739	546	-26.1%
Year 13	341	219	-35.8%
Public Finance Surpluses or Deficits Rio Blanco County			
Year 7	-8,352,688	-7,239,296	+13.3%
Year 13	-11,774,404	-8,218,076	+30.2%
Town of Meeker			
Year 7	-1,447,910	-455,712	+68.5%
Year 13	-3,528,950	-1,765,115	+50.0%
School District RE 1			
Year 7	4,728,202	6,835,932	+44.6%
Year 13	26,411,089	30,181,760	+14.3%

*Housing needs which are not reflected in effective demand, given forecasted costs and household incomes, and are therefore not likely to be met.

Exhibit III-5 explores the sensitivity of northwest Colorado results to other areas of methodological uncertainty:

- Estimates of nonbasic activity--Sensitivity Analyses 3a and 3b show the effects of plausible decreases or increases in the basic/nonbasic multiplier used to forecast nonbasic economic activity.

- Importance of detailed public expenditure modeling--Sensitivity Analysis 4 uses simplified procedures and national cost standards rather than the more detailed approach of the demonstration methodology for estimating public expenditures.

- Importance of lags and/or acceleration in the build-up of nonbasic activity--Sensitivity Analysis 5a requires a longer lag time before allowing the rest of the local economy to respond to increases in energy activity. Sensitivity Analyses 5b and 5c allow for different (lower) rates of build-up once the response has begun.

While not insignificant, the errors associated with misspecifying these detailed methodology assumptions are far lower than those associated with either the build-up of energy developments themselves or the geographic distribution question.

In the long-term, the most sensitive of the methodological issues is the choice of an economic multiplier. Placing the multiplier at its reasonable lower bound leads to more than a 50 percent difference in long-term housing demand forecasts. In the short-term, the most sensitive choice is the public expenditure modeling technique. Using a simpler technique than that described in the demonstration methodology produces much more favorable forecast (a difference of 50 percent) of public finance problems during the seventh year.

Another significant methodological issue is the use of primary vs. secondary data. Assessments based only on secondary data have practical advantages: they can be accomplished at lower cost and without intruding

EXHIBIT III-5. SENSITIVITY OF SELECTED RESULTS TO CHANGES IN ASSESSMENT METHODOLOGY AND ESTIMATED IMPACTS (NORTHWEST COLORADO CASE STUDY)

Impact Measure	Scenario II Value	Sensitivity Analysis 3a (Lower Nonbasic Activity) Value	% Change*	Sensitivity Analysis 3b (Higher Nonbasic Activity) Value	% Change*	Sensitivity Analysis 4 (Simplified Public Finance Methodology) Value	% Change*	Sensitivity Analysis 5a (Slower Build-up of Nonbasic Activity) Value	% Change*	Sensitivity Analysis 5b (No Accelerator Effect) Value	% Change*	Sensitivity Analysis 5c (Low Accelerator Effect) Value	% Change*
Employment in Rio Blanco County													
Year 7	15,087	13,000	-13.8%	16,703	+10.7%	15,087	0%	14,591	-3.3%	12,832	-14.9%	13,594	-9.9%
Year 13	26,181	20,165	-23.0%	29,271	+11.8%	26,181	0%	25,850	-1.3%	24,833	-5.1%	25,289	-3.4%
Population in Rio Blanco County													
Year 7	35,200	30,545	-13.2%	38,803	+10.2%	35,200	0%	34,092	-3.1%	30,171	-14.3%	31,870	-9.5%
Year 13	61,016	47,599	-22.0%	67,906	+11.3%	61,016	0%	60,277	-1.2%	58,009	-4.9%	59,025	-3.3%
Housing													
Total Demand													
Year 7	2,328	2,229	-4.3%	2,537	+9.0%	2,328	0%	2,269	-2.5%	1,653	-29.0%	1,889	-18.9%
Year 13	1,751	665	-62.0%	1,845	+5.4%	1,751	0%	1,849	+5.6%	1,422	-18.8%	1,536	-12.3%
Total Residual**													
Year 7	739	1,573	+112.8%	853	+15.4%	739	0%	714	-3.4%	539	-27.1%	598	-19.1%
Year 13	341	239	-29.9%	378	+10.9%	341	0%	385	+12.9%	288	-15.5%	302	-11.4%
Public Finance Surpluses and Deficits													
Rio Blanco County													
Year 7	-8,352,688	-8,256,828	+1.1%	-10,631,362	-27.3%	-4,016 209	+51.9%	-9,288,817	-11.2%	-8,166,665	+2.2%	-8,659,161	-3.7%
Year 13	-11,774,404	-9,147,159	+22.3%	-14,966,157	-27.1%	-5,294,396	+55.0%	-12,805,004	-8.8%	-12,171,005	-3.4%	-12,450,527	-5.7%
Town of Meeker													
Year 7	-1,447,910	-1,289,532	+10.9%	-1,394,109	+3.7%	-610,550	+57.8%	-1,311,384	+9.4%	-1,544,899	-6.7%	-1,362,709	+5.9%
Year 13	-3,528,950	-2,961,823	+16.1%	-3,584,355	-1.6%	-2,224,039	+37.0%	-3,298,421	+6.5%	-3,364,920	+4.6%	-3,494,828	+1.0%
School District RE-1													
Year 7	4,728,202	5,412,244	+14.5%	4,293,012	-9.2%	4,748,746	+.4%	4,987,685	+5.5%	5,405,709	+14.3%	5,296,900	+12.0%
Year 13	26,411,089	28,054,740	+6.2%	25,395,453	-3.8%	26,157,025	-1.0%	26,478,414	+.3%	26,789,624	+1.4%	26,546,190	+.5%

*Changes are expressed as a percentage of Scenario II values.

**Housing needs which are not reflected in effective demand, given forecasted costs and household incomes, and are therefore not likely to be met.

on the potentially affected community. In order to examine the feasibility of using only secondary data and the potential loss of accuracy, the southeastern Utah case study was performed first using only secondary data. The case study was then repeated using primary data. Exhibit III-6 illustrates the results for those impact categories where forecasts are quantifiable. Very large differences were found for most forecasts. In addition, many of the "softer" portions of the demonstration methodology (e.g., the identification of institutional constraints to housing development and of potential social problems) could not be accomplished at all without local interviews.

EXHIBIT III-6. SENSITIVITY OF SELECTED RESULTS TO USE OF PRIMARY DATA (SOUTHEASTERN UTAH CASE STUDY)

Impact Measure	Scenario I Primary	Scenario II Primary Value	Scenario II Primary % Change	Scenario I Secondary Value	Scenario I Secondary % Change	Scenario II Secondary Value	Scenario II Secondary % Change
Employment in Carbon County							
Year 7	12,631	20,237	+60.2%	12,753	+1.0%	18,991	+50.4%
Year 13	12,433	21,992	+76.9%	13,776	+10.8%	22,450	+80.6%
Population in Carbon County							
Year 7	31,599	48,948	+54.9%	27,876	-11.8%	45,676	+44.5%
Year 13	29,823	53,509	+79.4%	29,858	+.1%	56,407	+89.1%
Income in Carbon County							
Year 7	3,630	34,036	+837.6%	4,911	+35.3%	33,105	+812.0%
Year 13	-351	6,485	+194.8%	4,235	+1306.6%	15,122	+4408.3%
Housing in Carbon County							
Total Demand							
Year 7	122	1,027	+741.8%	152	+24.6%	1,057	+766.4%
Year 13	10	229	+219.0%	134	+1240.0%	479	+469.0%
Total Residual							
Year 7	89	414	+365.2%	88	-1.1%	459	+415.7%
Year 13	-3	84	+2900.0%	46	+1633.3%	122	+4166.7%
Public Finance							
Surpluses and Deficits							
Carbon County							
Year 7	196,806	598,806	+204.3%	-36,080	-118.3%	-990,019	-603.0%
Year 13	-1,780,673	1,449,060	+181.4%	-159,020	+91.0%	-1,600,723	+10.1%
City of Price							
Year 7	219,758	-3,110,188	-1515.3%	1,014,645	+361.7%	-258,556	-217.7%
Year 13	-1,903,801	-4,608,508	-142.1%	977,699	+151.4%	-1,715,945	+9.9%
Carbon County School Dist.							
Year 7	4,327,175	9,529,721	+120.2%	790,173	-81.7%	223,704	-94.8%
Year 13	4,268,640	12,970,695	+203.9%	739,732	-82.7%	-76,673	-101.8%

IV. IMPLICATIONS

The findings of this project, particularly the finding of such a large degree of uncertainty in forecasting, have significant implications for each of the different participants in the assessment process:

Analysts preparing assessments

- Regardless of the accuracy of forecasts, analysts can do much more than they are now to identify impact categories and to facilitate mitigation responses.
  - At a minimum, all of the nine common impact assessment steps described earlier can be considered for inclusion in the assessment process. Public finance, housing, and sociocultural impacts are at least as significant as the traditional economic/demographic issues.
  - The results can be presented at the policy-related level of detail (e.g., public financial forecasts annually for each taxing jurisdiction).
  - The necessary resources can be devoted to obtaining primary data.
- Analysts should admit to the uncertainty in their forecasts, providing ranges and/or scenarios rather than point estimates.

Users of assessments

- Mitigation planning efforts must also be based on different potential scenarios, particularly different scenarios of energy development and of the geographic distribution of newcomers.
- A process of monitoring and reforecasting is needed to reduce uncertainty as energy development plans get closer to reality and as mitigation alternatives emerge. (This argues for close involvement of local and/or state planners in the assessment process and for use of computer-assisted, integrated assessment models.)

Designers of assistance programs

- Assistance programs, in order to be effective, must be able to respond to changing forecasts of local needs; and every effort should be made to develop capacity in local governments to deal with rapid change and uncertainty.

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The application of an integrated computer-assisted assessment process is useful in facilitating, not replacing, individual judgment. Experience is necessary in adjusting for faulty data, in integrating differences between past and future relationships (e.g., in the employment multiplier) and in analyzing sociocultural and other nonrecurring impacts. Further research, particularly research which develops data bases on which to base new inferences, will be helpful. However, significant improvements in the assessment process depend on increasing analysts' capacity for making informed judgments.